ENVIRONMENTAL CHANGE ANALYSIS ON AGRICULTURAL LAND CONVERSION IN PALEMBANG CITY, SOUTH SUMATERA, INDONESIA

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ABSTRACT: The existence of agricultural land is indirectly related to the environment. The existence of agricultural land in terms of environmental aspects can provide five types of benefits, namely preventing flooding, controlling water balance, preventing erosion, and reducing environmental pollution from household waste. This research aims to analyze environmental changes in the conversion of agricultural land to non-agricultural activities in Palembang City. This research uses quantitative methods, analytical quantitative research is conducted to accept or reject hypotheses that are described by significance values. The research also used qualitative methods by conducting measured interviews with 250 respondents. The research was conducted in May 2023 in three sub-districts in Palembang City, namely Kalidoni, Kertapati, and Gandus sub-districts. The environmental indicators used as a reference include water quality, air quality, soil conditions, traffic conditions, runoff water conditions, plant conditions, and animal conditions. The results showed that the condition of plant environmental quality in the Gandus and Kalidoni sub-districts is classified as poor, while the Kertapati sub-district is in the good category. While the condition of the environmental quality of animal indicators in the Kertapati and Kalidoni sub-districts is in the good enough category, but in the Gandus sub-district it is in the bad category. Dragonfly populations will be high if the habitat conditions are very suitable. This means that there are still streams or puddles that are still clean and food is available. This clean water is the place for dragonfly eggs and images for further development. So if the dragonfly population at a location is still high, it means that the water conditions at that location are still not polluted.

Keywords: Carrying Capacity, Development, Feasibility, Paddy Field, Use.

INTRODUCTION

Agricultural land has a low land value compared to land used for non-agriculture, because it has a low value, it is not uncommon for agricultural land to experience a change of function to non-agriculture. This change of function occurs due to economic growth and increasing population growth, but the

consequences of this change of function interfere with the production of rice (rice) (Widowaty et al., 2021).

Land is one of the resources that cannot be produced, causing availability to be limited, due to the high demand for land causing land to be limited (Febrina, 2017). Indonesia's agricultural land area in 2016-2018, which is divided into non-field agricultural land and paddy fields. The area of non-field agriculture in 2016 was 28,555,790 hectares, followed by 29,121,269 hectares in 2017, and 27,724,917 hectares in 2018 (Ardani, 2020). Based on these data, in the last three years, namely 2016-2018, the area of non-field agricultural land has decreased and in 2018 occupied the smallest area compared to the previous two years. Meanwhile, the area of paddy fields in 2016-2018, in 2016 amounted to 8,187,734 hectares, then in 2017 paddy fields amounted to 8,164,045 hectares, and in 2018 paddy fields amounted to 7,105,145 hectares (Ardani, 2020). This data shows a decrease in the amount of paddy fields in the last three years.

The existence of agricultural land is indirectly related to environmental aspects, where the existence of agricultural land from environmental aspects can provide five types of benefits, namely preventing flooding, controlling water balance, preventing erosion, and reducing environmental pollution from household waste. Some other environmental services from the existence of agricultural land are improving groundwater quality, preventing landslides, and maintaining air quality because it is free of dust and CO2 pollution (Angraini et al., 2020). Rice fields continue to decline or decrease due to changes in land functions from agriculture to non-agriculture (Fuadi & Handayani, 2023).

Badoa et al. (2018) in their research stated that the triggering factors for land conversion carried out by the community were economic, sociocultural factors, and policies. Where economic factors greatly influence land conversion such as high land selling prices. According to Amalia's (2014) research states that the factors affecting the conversion of agricultural land are influenced by population density and productivity of paddy fields. Factors affecting the conversion of agricultural land at the farm level are influenced by land area, number of family members, and number of dependents. Another reason that influences land conversion is related to the production costs incurred by farmers. Because the smaller the land area, the higher the production costs will be more expensive, so that, the smaller the agricultural land, the more farmers will think about converting their land (Kusumastuti et al., 2018).

Environmental degradation is a decline in the quality of the environment that has the potential to harm human life. Environmental degradation can be caused by two main factors, namely nature and humans (Suandy et al., 2014). In general, environmental degradation causes many losses such as physical damage, loss of life, disease, climate change, and famine. Losses due to environmental degradation can also be seen from various other indicators such as scarcity of clean water sources, and water and air pollution. The emergence of environmental degradation is caused by human activities such as land conversion and critical land. Land conversion is a change in land use from non-built land to built land such as rice fields to settlements (Santoso & Nurumudin, 2020).

Palembang City is the capital city of South Sumatra which has a lot of agricultural land, especially rice fields, but over time the rice fields in Palembang City began to decrease. Based on data from the Palembang City Agriculture and Food Security Office, the standard area of paddy fields in Palembang City 2017-2021 in 2018 decreased by 0.04%, in 2019 it decreased from the previous year by 0.29%, and in 2020 it decreased by 0.20%. The trigger factor for this reduction in paddy fields may be due to the conversion of paddy fields that occurred in Palembang City. The development of Palembang City has resulted in a change of function in the use of agricultural land for wetland rice paddies which causes, the area of agricultural land from year to year to continue to decline. Land use change from wetland rice farming to non-agricultural land in Palembang City not only eliminates the opportunity to produce rice but can also threaten the survival of farmers and environmental fragmentation. Based on the problems presented above, it is necessary to analyze environmental changes in the conversion of agricultural land in Palembang City.

Previous research conducted by Monsaputra (2023), titled "Analysis of the Conversion of Agricultural Land to Housing in the City of Padang Panjang" showed that Pasar Baru Subdistrict experienced the highest percentage of land conversion at 46%. This conversion mainly occurred in areas with low population density, accounting for 67%, and within a 50-meter road buffer zone, accounting for 64.47%. The spatial pattern of residential land from 2010 to 2019 in Padang Panjang City was clustered. The analysis results also showed a shift in the direction of residential development towards the southeast by 300 meters.

Subsequent research conducted by Hidayati et al. (2024), titled "Analysis of the Impact of Agricultural Land Conversion on Farmers' Income in Mimika Regency" showed that there was a significant difference in the average income of farmers before converting their land, which was Rp 28,109,863, and after converting their land, which became Rp 34,906,863, with an average difference of Rp 6,797,000. This means that by converting their land, farmers experienced a greater increase in income compared to before the conversion. This increase is attributed to the regular monthly income, albeit uncertain, derived from renting out boarding houses, fishing ponds, recreational bathing sites, and other sales from kiosk and shop businesses, compared to when the land was used for agriculture, which did not guarantee a stable income. The novelty of this research lies in its focus on three districts in the city of Palembang, namely Kalidoni, Kertapati, and Gandus. The environmental indicators used as references include water quality, air quality, soil conditions, traffic conditions, runoff water conditions, plant conditions, and animal conditions.

METHOD

This research uses quantitative methods, analytical quantitative research is conducted to accept or reject hypotheses that are described by significance values. The research also uses qualitative methods by conducting measurable interviews with respondents, researchers have prepared research instruments in the form of written questions whose alternative answers have also been prepared to aim to analyze in depth through the opinions of policymakers regarding land conversion

of community leaders and representatives, farmers who know the occurrence of agricultural land conversion in Palembang City. The research was conducted in May 2023 until completion. The research location is in three sub-districts in Palembang City where there are activities of agricultural land conversion to non-agricultural activities, namely Kalidoni District, Kertapati District, and Gandus District. Researchers determined the research location by the research theme and by the formulation of research problems by purposive sampling.
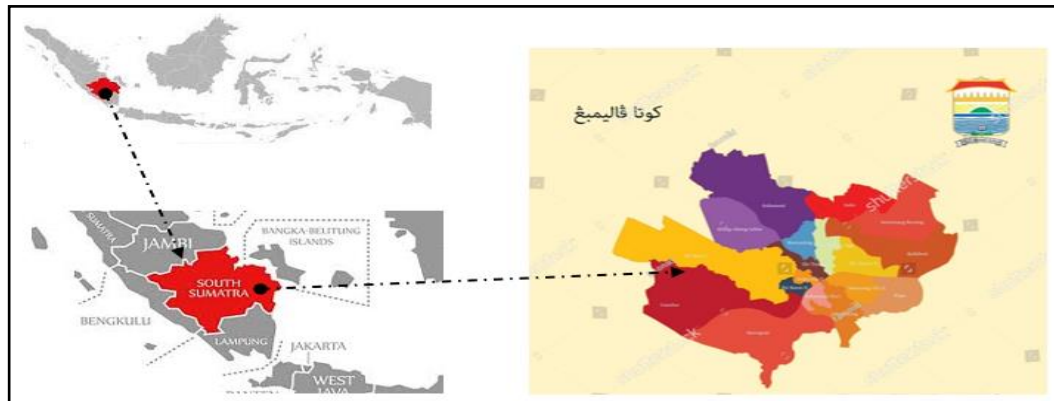

Figure 1. Research Location in Palembang City, South Sumatera, Indonesia.

The sampling technique used in this study is ten disproportionate stratified random samplings (proportional stratified random sample), in practice often encountered an inhomogeneous population. The more heterogeneous a population, the greater the difference in nature between the layers. The precision and results that can be achieved by using a sampling method are influenced, among other things, by the degree of uniformity of the population concerned (Creswell, 2009). To be able to accurately describe the properties of a heterogeneous population, the population is divided into uniform layers (stratum), and from each layer, a random sample is taken. In a proportional stratified random sample, the chances of being selected from one stratum to another may be the same or may be different. In this study, the number of respondents was 250 from three sub-districts, namely Kalidoni District, Kertapai District, and Gandus District.

After the data is collected, the next process is to simplify the data obtained into a form that is easy to read, understand, and interpret which is essentially an effort to find answers to existing problems. Therefore, the data obtained will then be analyzed qualitatively. This means that the existing data is analyzed as detailed as possible by carefully abstracting any information obtained in the field so that it is hoped that adequate conclusions can be obtained.

RESULTS AND DISCUSSION

Table 1 presents the results of a study on the levels of community perceptions of environmental quality in Gandus Sub-district. The data reflects the community's views on various aspects of their environment, highlighting the overall satisfaction and concerns within the sub-district.

Table 1. Levels of Community Perceptions of Environmental Quality in Gandus Sub-District.

No.	Components of Environmental Quality	Perception of the Environment Gandus Sub-District (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	Airwater					
1	Well water depth increases	3	14	16	2	0
2	Well water is now murkier	14	10	11	1	0
3	Well water in the current dry season is reduced	18	14	3	0	0
4	Increased turbidity of river water	13	13	9	0	0
5	Silting of rivers and springs	13	11	9	1	0
	Air					
6	Increased noise	6	14	14	1	0
7	Disturbing noise occurs	6	16	11	2	0
8	Increase in air temperature	14	16	4	0	0
9	The air is not fresh enough	16	11	8	0	0
	Land					
10	Soil is more easily arid and less fertile	11	14	8	1	0
	Road Traffic					
11	An increase in disruptive congestion	5	16	12	1	0
	Output Water					
12	Increased volume of rubbish on the streets	14	17	3	0	0
13	There is standing water (leading to flooding) when it rains	13	15	7	0	0
	Growth					
14	The number of large trees was reduced	2	22	11	0	0
15	There are locally extinct plant varieties	3	13	16	2	1
	Animals					
16	Dragonflies are increasingly rare	15	7	10	2	0
17	There are varieties of animals that are locally extinct	6	12	14	3	0

The level of community perception of environmental quality in the Gandus Sub-district in detail can be seen in Table 1. Community perceptions were assessed from several indicators consisting of 17 sub-indicators or questions. Based on the results of the study, most respondents in Gandus Sub-district strongly agreed that the depth of well water increased, well water in the current dry season decreased, there was an increase in turbidity of river water and well water, and siltation of rivers and springs.

From the air aspect, 14 percent of respondents agreed that there was an increase in noise, and 6 percent strongly agreed, while 14 percent were neutral. Furthermore, 16 percent agreed and 6 percent strongly agreed that there was disturbing noise due to land conversion in Gandus Sub-district. An increase in air temperature that causes the air to be less fresh is also an impact felt by the community in Gandus Sub-district due to land conversion.

In addition, people also felt that the land was more arid and less fertile, and there was a disturbing increase in traffic. Looking at the runoff water indicator, most respondents also strongly agreed that there is an increase in the volume of rubbish on the streets and there are puddles (leading to flooding) when it rains. Based on the plants and animals indicator, most respondents also stated that land conversion in the Gandus Sub-district hurts the environment. It can be seen from the number of large trees decreasing, there are varieties of plants and animals that are locally extinct, and dragonflies are increasingly rare. The biological component consists of animals and plants, with the presence of large plants as a reference because they do more good things for the environment, especially in terms of their relationship with groundwater absorption, landslide prevention, and habitat for biodiversity.

Furthermore, dragonflies are environmental indicator animals. The presence of dragonflies in a place indicates the condition of the environment. If there is a high population of dragonflies in an area, this indicates that the area is still clean. Conversely, if an area has a low dragonfly population, then the area is polluted, especially the waters. Moreover, if the population is missing, this indicates a certain condition in nature (environmental condition). Reduced dragonfly populations in an area can be an indication of changes in water quality and the environment. For this reason, the environment must be maintained and preserved so that certain types of animals such as dragonflies do not become extinct or disappear (Simbolon, 2019). Furthermore, community perceptions of environmental quality in the Kertapati Sub-district can be seen in Table 2.

Table 2. Level of Community Perception of Environmental Quality in Kertapati Sub-District.

No.	Components of Environmental Quality	Perception of the Environment Sub-district Kertapati (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	Airwater					
1	Well water depth increases	17	11	7	1	0
2	Well water is now murkier	10	12	13	2	0
3	Well water in the current dry season is reduced	17	14	5	0	0
4	Increased turbidity of river water	13	16	7	0	0
5	Silting of rivers and springs	6	14	16	0	0
	Air					
6	Increased noise	4	12	18	2	1
7	Disturbing noise occurs	3	12	18	2	1
8	Increase in air temperature	12	15	9	0	0
9	The air is not fresh enough	14	13	9	0	0
	Land					
10	Soil is more easily arid and less fertile	5	20	11	0	0
	Road Traffic					
11	An increase in disruptive congestion	7	8	14	6	0
	Output Water					
12	Increased volume of rubbish on	14	18	4	0	0

No.	Components of Environmental Quality	Perception of the Environment Sub-district Kertapati (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	the streets					
13	There is standing water (leading to flooding) when it rains	12	13	11	0	0
	Growth					
14	The number of large trees was reduced	2	20	14	0	0
15	There are locally extinct plant varieties	4	9	15	8	0
	Animals					
16	Dragonflies are increasingly rare	10	9	17	0	0
17	There are varieties of animals that are locally extinct	0	11	15	10	0

Land conversion not only causes a decline in rice productivity but also causes changes in environmental quality and of course, the livelihoods of farming households, which are an important part of the agricultural sector. The level of community perception in the Kertapati Sub-district towards changes in environmental quality shows similar results to the Gandus Sub-district. Most respondents agreed and strongly agreed that the water quality at the site had increased in depth, was more turbid, well water was reduced, and the siltation of springs. This is in line with the statement that some of the main types of activities that cause river pollution include: 1) deforestation; 2) conversion of forests to agricultural land and plantations; and 3) conversion of forests to built-up land.

Figure 2. Conversion of Agricultural Land into Transport Routes.

Similarly, the air and soil conditions have decreased in quality, such as increased noise, and air temperature, and the soil has become more arid. An increase in the volume of rubbish on the streets is also felt by the community in Kertapati Sub-district. The presence of standing water (leading to flooding) when it rains is supported by the statements of respondents who mostly agreed. In terms of flora, the number of large trees has also decreased but local varieties are less affected. On the fauna side, 10 percent of respondents strongly agreed, 9 percent agreed and 17 percent were neutral on the statement that dragonflies are becoming less common. And most respondents expressed neutral (15), disagree (10), and agree (11) with the statement that there are local extinct animal varieties.

This research supports a previous study conducted by Monsaputra (2023), where it was found that the majority of conversions occurred in areas with low population density, accounting for 67%, and within a 50-meter road buffer zone, accounting for 64.47%. The spatial pattern of residential land from 2010 to 2019 in Padang Panjang City was clustered. The analysis results also showed a shift in the direction of residential development towards the southeast by 300 meters.

Table 3. Level of Community Perception of Environmental Quality in Kalidoni Sub-District.

No.	Components of Environmental Quality	Perception of the Environment Kalidoni Sub-district (%)				
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	Airwater					
1	Well water depth increases	7	11	8	2	0
2	Well water is now murkier	7	8	12	1	0
3	Well water in the current dry season is reduced	6	14	8	1	0
4	Increased turbidity of river water	5	14	9	0	0
5	Silting of rivers and springs	4	14	11	0	0
	Air					
6	Increased noise	4	15	10	0	0
7	Disturbing noise occurs	4	16	8	1	0
8	Increase in air temperature	17	9	3	0	0
9	The air is not fresh enough	18	8	3	0	0
	Land					
10	Soil is more easily arid and less fertile	14	8	8	0	0
	Road Traffic					
11	An increase in disruptive congestion	12	10	6	0	0
	Output Water					
12	Increased volume of rubbish on the streets	17	10	2	0	0
13	There is standing water (leading to flooding) when it rains	10	12	7	0	0
	Biology					
	Growth					
14	The number of large trees was reduced	0	17	12	0	0
15	There are locally extinct plant varieties	10	5	14	0	0
	Animals					
16	Dragonflies are increasingly rare	6	7	16	0	0
17	There are varieties of animals that are locally extinct	0	6	20	2	0

Based on the results of the analysis in Table 3, seen from the water indicator, the respondents' statements are quite varied, although on average the water quality in Kalidoni Sub-district has decreased due to land use change, likewise with air quality, soil, road traffic, and runoff water. From the plant indicator, as many as 17 percent agreed and 12 percent stated neutral on the statement that the number of large trees had decreased. As many as 10 percent

strongly agreed, 5 percent agreed, and 14 percent were neutral on the statement that there are local extinct plant varieties. Furthermore, for the dragonfly population in Kalidoni Sub-district, 6 percent strongly agreed, 7 percent agreed, and 16 percent were neutral on the statement that dragonflies are increasingly rare. In addition, 6 percent of respondents agreed that there are locally extinct animal varieties, 20 percent were neutral, and 2 percent disagreed. Furthermore, the average public perception can be seen in Table 4.

Table 4. Level of Community Perception of Environmental Quality in Palembang City.

Environmental Components	Gandus	Kertapati	Kalidoni
Water	Bad	Bad	Bad
Air	Bad	Bad	Bad
Land	Bad	Bad	Bad
Road Traffic	Bad	Good Enough	Bad
Runoff Water	Bad	Bad	Bad
Plants	Bad	Good Enough	Bad
Animals	Bad	Good Enough	Good Enough

The calculation results in Table 4 show that the changes in water quality in Palembang City, namely Gandus, Kertapati, and Kalidoni Sub-districts are very bad. This is caused by the quality of well water and river water in Gandus, Kertapati, and Kalidoni sub-districts has decreased significantly compared to before due to land use change. River quality is an indicator of whether the river is still in good condition or polluted. River pollution is defined as a change in the quality of a body of water due to human activities, which in turn will interfere with human life itself or other living things (Sofiana et al., 2023). The occurrence of land use change has caused environmental degradation. Environmental degradation can lead to loss of land productivity (Santoso & Nurumudin, 2020).

Angraini et al. (2020) stated that the impact of rice field function experts on environmental degradation could be detrimental to the community if it occurs in the long term, damaging soil texture, and polluting both soil, water, and air pollution. Air and soil quality conditions in Gandus, Kertapati, and Kalidoni sub-districts were also rated as very poor by most respondents. There is an increase in disturbing noise, an increase in air temperature, and the soil is more arid and less fertile.

The conversion of agricultural land puts food security and food sovereignty in jeopardy, especially for food production, environmental conditions, and the welfare of rural farmers whose lives depend on their land. In addition, the soil condition has become less fertile and more arid as a result of the conversion of agricultural land into non-agricultural land. Factors that cause environmental damage covering aspects of land, sea, and air are largely caused by two factors, namely natural factors and human factors. Environmental damage due to natural factors is a natural event that has an impact on environmental damage such as volcanic eruptions, earthquakes, hurricanes, floods, etc. Meanwhile, land conversion to non-agricultural land is a category of human factor environmental damage.

Damage to environmental conditions means that certain functions become less useful or may not be used at all. Land conversion without following spatial

planning regulations has the potential to cause damage and loss of land characteristics. Damage that affects the environment in the short, medium, and long term will more easily occur on land that has lost its characteristics (Riskanita & Widowaty, 2019).

Furthermore, in terms of traffic flow, the people of Gandus and Kalidoni sub-districts have the perception that there has been a decline in the quality of traffic flow although it is not included in the category of annoying congestion, while Kecamatan Kertapati still feels that traffic flow conditions are still quite good. As for runoff water conditions, all three sub-districts expressed poor perceptions. An increase in the amount of rubbish on the road and standing water (leading to flooding) during rainfall are problems in all three sub-districts affected by land use change.

One of the causes of inundation is due to land use change, waste disposal, settlements in riverbank areas, and improper planning of the flood control system. As a result, rainwater that was previously accommodated in the rice field area before it was converted no longer accommodates, flows without control, and pools in certain places or floods. Conversely, rainwater no longer seeps into the ground because the paddy fields have been converted. In the area of land conversion in question, water must be stored to cope with flooding water flows on the surface of settlements as Surface runoff, or surface water flow, even as storm water. Ironically, when the dry season arrives, many shallow wells run out of the water (Putrawan et al., 2019).

The condition of plant environmental quality in the Gandus and Kalidoni sub-districts is classified as poor, while the Kertapati sub-district is in the good category. While the condition of the environmental quality of animal indicators in the Kertapati and Kalidoni sub-districts is in the good enough category, but in the Gandus sub-district it is in the bad category. Dragonfly populations will be high if the habitat conditions are very suitable. This means that there are still streams or puddles that are still clean and food is available. This clean water is the place for dragonfly eggs and images for further development. So if the dragonfly population at a location is still high, it means that the water conditions at that location are still not polluted. Likewise, dragonfly nymphs are very sensitive to environmental changes (Simbolon, 2019).

CONCLUSION

The analysis of environmental changes due to the conversion of agricultural land into non-agricultural activities in Palembang City reveals several important findings related to geophysical and chemical indicators. In terms of geophysical indicators, significant changes in soil and water flow conditions were observed. The research indicates that the conversion of agricultural land has led to soil degradation in several areas, particularly in the districts of Gandus and Kalidoni, resulting in a decline in soil quality. Water flow is also affected, with changes observed as a consequence of land use change.

Regarding chemical indicators, there is an increase in water and air pollution associated with land conversion. The research findings show that water and air quality in several areas have significantly deteriorated due to increased

non-agricultural activities. Water and air pollution can have serious negative impacts on ecosystems and human health. Thus, it can be concluded that the conversion of agricultural land in Palembang has significant environmental impacts, especially in terms of geophysics and chemistry. Efforts to preserve and protect the environment are crucial to prevent further damage and ensure the sustainability of a healthy environment in the future.

The result of this study is that the condition of plant environmental quality in the Gandus and Kalidoni sub-districts is classified as poor, while the Kertapati Sub-district is in the good enough category. While the condition of the environmental quality of animal indicators in the Kertapati and Kalidoni sub-districts is in the good enough category, but in the Gandus sub-district it is in the bad category.

RECOMMENDATION

Based on the research results, both farmers and parties involved in converting paddy fields to non-agricultural uses must pay attention to the condition and state of the environment resulting from land-use changes, especially the negative impacts that cause environmental damage from Geo-Physical-Chemical as well as Biological aspects.

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